

## II.—ZOOLOGY.

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ART. XVI.—*Further Notes on Coccididæ, with Descriptions of New Species from Australia, Fiji, and New Zealand.*

By W. M. MASKELL, F.R.M.S., Cor. Mem. Royal Society of South Australia.

[Read before the Wellington Philosophical Society, 2nd October, 1889.]

Plates IV. to IX.

SINCE the publication of my book on the scale-insects of New Zealand a few new species of this family have been brought under my notice, chiefly from localities which I have not been able to visit, and from trees on which I could make no personal observations. In addition, some insects have been sent to me for identification from New South Wales and from Fiji, and I have included them in the present paper.

I have to tender my thanks to Mr. G. Bennett, of Sydney; to Mr. R. L. Holmes, of Bua, Fiji; and to Messrs. R. Raithby and T. Cavell, of Inangahua, New Zealand, who have very kindly sent me numerous specimens from their respective localities. Mr. Holmes has sent me a fine collection of Coccids, Aleurodids, and Aphids; and the two last-named gentlemen have been specially assiduous, and have spared no trouble in their assistance to me.

### Group DIASPIDINÆ.

Genus MYTILASPIS, Targioni-Tozzetti.

**Mytilaspis grisea**, sp. nov. Plate IV., fig. 1.

Female puparium light-grey, narrowish, elongated, slightly curved, convex, rather solid, about  $\frac{1}{12}$  in. long; mussel-shaped; pellicles rather small.

Male puparium similar, but much smaller, averaging not more than  $\frac{1}{14}$  in.; not carinated.

Adult female dark-red, or nearly black, elongated, of the normal form of the genus. Abdomen ending in four inconspicuous lobes, of which the two median are rather the largest; only a few spines on the edge. Pygidium with five groups of spinnerets; upper group with 4-6 orifices; lateral groups, 12-15; several single spinnerets. Length of female, about  $\frac{1}{14}$  in.

Adult male unknown.

*Hab.* In Australia, on various species of *Eucalyptus* and on *Acacia*, sp. My specimens are from New South Wales.

There is little beyond colour to distinguish the female of this species, when extracted from the puparium, from several others of the genus; and colour is probably not of much account. However, the dark-red of this insect is uncommon; but the light-grey solid puparium is not likely to be mistaken for any other. From the numbers of specimens on the twigs sent to me I should imagine that the insect must be somewhat plentiful.

***Mytilaspis pallens*, sp. nov.** Plate IV., figs. 2-4.

Female puparium light greyish-green, elongated, flat, thin; rather widely pyriform in many specimens, narrower in others; straight or very slightly curved. Pellicles small; length averaging  $\frac{1}{10}$  in.

Male puparium resembling that of the female, but much smaller and a little more convex; not carinated. Length about  $\frac{1}{30}$  in.

Adult female very dark-brown or purple; general form normal of the genus, the cephalic region comparatively large. Abdomen ending in two lobes, with a median depression between them, and several much smaller, usually six on each side; on the edge some rather strong spines. All the abdominal segments bear strong spines at the edges, the last above the pygidium having six or eight. Pygidium with five groups of spinnerets, which often appear as a continuous arch: upper group, 11-14 orifices; upper laterals, 14-20; lower laterals, 18-24; many single spinnerets.

Adult male dark-brown; length, exclusive of the abdominal tubercle and spike, about  $\frac{1}{50}$  in. The spike is very long, equaling (including the tubercle) three-fourths of the length of the body. Antennæ rather thick, hairy, with ten joints; otherwise presenting no special features. Feet also rather thick; digitules fine hairs.

*Hab.* (?) My specimens were sent to me from New South Wales, on a species, apparently, of fan-palm grown in a greenhouse; but I am unable to say what is the ordinary food-plant.

In the margin of the abdomen, in the lobes and median depression, and in the arrangement of the strong spiny hairs, especially those on the abdominal segments, the female of this species approaches to the New Zealand form *Mytil. phymatodidis*, Mask., which is common here on ferns; but the puparium differs considerably in size, in colour, and in texture, being much more solid; and the spinneret-groups also differ. The male of *M. phymatodidis* has not yet been observed. Perhaps the great proportionate length of the abdominal spike in the male of *M. pallens* may be a distinguishing character.

**Mytilaspis citricola**, Packard.

*Aspidiotus citricola*, Packard ("Guide to the Study of Insects," 1870, p. 527).

*Mytilaspis citricola*, Packard (Comstock, "U.S. Ag. Rep.," 1880).

This insect occurs on the rind of some oranges forwarded to me by Mr. Raithby, of Inangahua. The oranges, as I understand, came originally from Fiji, and the species must therefore be added to the Fijian fauna. My specimens have perhaps a slightly broader and thinner female puparium, and a rather lighter colour than the type. But, after comparing them with undoubted specimens of *M. citricola*, forwarded to me by Dr. F. Löw, of Vienna, I have no doubt of their identity. They seem, indeed, to be a good example of the necessity, as I think it, of neglecting in the Diaspid group mere outward appearance, and relying chiefly on microscopic differentiation. If only the colour and form of the puparia were taken into account it would be easy to make half-a-dozen species of the specimens on a single piece of orange-peel.

Genus DIASPIS, Costa.

**Diaspis santali**, mihi, "Scale-Ins. of N.Z.," p. 47.

This insect has in the last three or four years replaced and almost driven out *Aspidiotus camellie* on *Euonymus* and *Acacia* trees about Wellington. The two may still be found together sometimes, *A. camellie* being much the less frequent: usually *D. santali* has taken complete possession, the trees only suffering the more for the change. It is also appearing on a good many native trees in various places—*c.g.*, *Carpodetus*, *Vitex*, *Melicytus*, &c.

Genus CHIONASPIS, Signoret.

**Chionaspis dysoxyli**, mihi, "Scale-Ins. of N.Z." p. 55.

In the last twelve months two curious facts have occurred in connection with this insect, one of which is, as far as I know, unique. First, although up to 1889 I had not detected the species on any other plant than *Dysoxylon spectabile*, in February of that year I found it occurring somewhat plentifully on *Melicytus ramiflorus*, in the Wellington public gardens. In March the numbers on *Melicytus* seemed to have considerably increased; and all through the winter these trees became covered with masses of *Chionaspis*, not only on the leaves but also on the twigs and branches, until suddenly, in August, the insects disappeared as rapidly as they had come. They left the plants considerably dilapidated by their attacks, although these had lasted only so short a time, and that chiefly in winter: at the same time, it happened that the winter of this

year was extraordinarily mild and dry. This disappearance of theirs was, indeed, so sudden that, whereas in July, when procuring specimens of male pupæ for hatching, I could have carried away untold thousands, in August I could scarcely find any, and had to hunt over a good deal of ground to procure a dozen infected leaves of *Melicytus*. I cannot offer an explanation of this peculiar invasion and departure. A similar circumstance, but in a much less pronounced way, was noticed by me in 1879 in the case of *Lecanium hesperidum* (see "Trans. N.Z. Inst.," vol. xii., p. 292): that insect, in a dry season, had become considerably lessened in numbers; but its appearance and disappearance were not by any means as peculiarly rapid as those of *C. dysoxyl*i in 1889.

The second and much more curious fact in connection with the insect is the emergence of a number of *apterous* males. I had not the male of the species before this year, but, finding the male puparia on *Melicytus* so numerous, I collected many, with a view to procuring the adult. The result was that I was able to hatch them out as follows: In February, four; in March, eleven; in May, eight; in June, sixteen; in July, eleven; and in August, two. I was particular in taking note of the numbers at the time I procured them, because the occurrence of an apterous male at once arrested my attention; and for the same reason I am particular in recording them now. I know of no similar instance amongst Coccids of any group: no observer has, I believe, recorded the existence of an apterous male, unless the extraordinary statements of M. Moniez ("Comptes Rendus de l'Acad. des Sci.," February, 1887), regarding males of *L. hesperidum* existing within the abdomen of the females can be accepted as positive. All male Coccids have hitherto been considered as having two wings: there is a case reported by Dr. Signoret ("Essai," p. 320) of *Gossyparia ulmi*, where the male has "rudimentary elytra," but Signoret himself doubts whether the insects he saw were really adult.\*

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\* In the August, 1889, number of Professor Riley's excellent publication, "Insect Life," which has just reached me, Mr. L. O. Howard gives a very full description of *Gossyparia ulmi*, which seems to have lately invaded European elms in America; and he figures both the male with rudimentary wings mentioned by Signoret, and the fully-winged male which also emerges from the cocoons. It seems, therefore, that *G. ulmi* and *C. dysoxyl*i are two insects with abnormal males; the difference being that in *G. ulmi* males with rudimentary wings emerge only "a few days," according to Mr. Howard, before the fully-winged forms, while in *C. dysoxyl*i males entirely wingless emerge for several months before the winged form appears.

While this paper is in the press I have received a note from Mr. Newstead, of the Grosvenor Museum, Chester, England, stating that he has bred both apterous and winged males of *Chionaspis fraxini*. Perhaps, now that attention is directed to the point, other observers may note similar occurrences.

But here is an instance of a large number of certainly adult males without the least semblance of a wing. I hatched, as observed just now, fifty-two males from February to August. Of these, only one, which emerged on the 26th August, was winged. This particular specimen has the wings developed in the usual style, and is in all respects a normal Diaspid; all the other fifty-one were absolutely apterous. I cannot look upon this as a normal state of things: there is nothing in the conditions of the female *C. dysoxylæ* to lead one to expect a variation in the male of so fundamental a nature. Yet, considering that my specimens were so numerous, and that they emerged at various times during a period of seven months, I think the fact of their apterous form is of importance.

I append the following description of the male:—

**C. dysoxylæ:** Adult male bright-red in colour, of the normal form of *Diaspidinæ*; length, exclusive of abdominal spike, about  $\frac{1}{30}$  in.; the spike is about half as long as the body. Head normal; eyes, four—two dorsal, two ventral. Antennæ of nine joints, the first two very short, the next six subequal and as long as the first two together, the ninth shorter and fusiform; all the joints are hairy. Feet normal, hairy, rather thick; digitules fine hairs. Wings, where present, normal, but many specimens found entirely apterous.

The nine-jointed antennæ may here be a distinguishing character: I know of no other Diaspid male with less than ten joints.

Genus *FIORINIA*, Targioni-Tozzetti.

**Fiorinia asteliæ**, mihi, "Scale-Ins. of N.Z.," p. 58.

Trees of *Pittosporum tenuifolium*, in the garden of the Club, Wellington, have been this year covered with great numbers of small white puparia, which at first sight might easily be taken for those of some species of *Chionaspis*, but which prove to be male puparia of *F. asteliæ*. Here and there a few females occur, but very sparingly; more than 90 per cent. seem to be males. The twigs of the plants are quite white with them.

Group LECANIDINÆ.

Subdivision LECANIDÆ.

Genus LECANIUM, Illiger.

**Lecanium chirimoliæ**, sp. nov. Plate IV., figs. 5–15.

Adult female very slender, long, and narrow; length averaging nearly  $\frac{1}{16}$  in.; width from  $\frac{1}{20}$  in. to  $\frac{1}{12}$  in.; colour light-brown (sometimes with a greenish tinge), faintly marked with irregular darker patches. Body very convex above, quite smooth, concave or flat beneath; usually much attenuated



towards the extremities; rather thin and translucent towards the edges. Margins bearing short, fine hairs, not set closely together. Viewed dorsally, the eyes appear near the cephalic extremity; viewed ventrally, the antennæ are placed a long way from the extremity, and the rostrum, between the first pair of legs, is almost at half the whole length. Epidermis exhibiting small, sparse, oval spots, very inconspicuous, irregularly arranged. Mentum uni-articular. Eyes duplex; outer portion orbicular, slightly prominent, yellow, resting on a broadish black base. Spiracular spines not longer than the rest. Antennæ slender, of seven joints—the fourth the longest, the third next, the first fifth and sixth the shortest, the seventh fusiform and bearing several hairs. Feet slender; the tibia is slightly dilated at the end, and bears a spine; upper digitules fine hairs, lower pair somewhat dilated. The abdominal cleft is very long and narrow; the two dorsal lobes small, rather sharply triangular, and closely adjacent.

Second stage of female resembling in general form and colour the adult, but smaller and flatter; length averaging  $\frac{1}{2}$  in. Antennæ of six joints.

Larva light-brown, elongated, elliptical; length about  $\frac{1}{36}$  in., convex above, flattish beneath; not clearly segmented; on the margin a few hairs, the spiracular spines no longer than the rest, as in the adult. Antennæ of six rather thick joints, subequal, the third joint a little the longest; all the joints dilated at the ends, except the last, which is fusiform; a few hairs on all the joints, and on the sixth several, of which four are very long—as long as the whole antenna. The feet present no special features.

Male unknown.

*Hab.* In Fiji, on both bark and leaves of chirimoya—*Annona (Chirimolia) tripetala*.

In colour, and in the sparse markings of the epidermis, this insect resembles *L. hesperidum*, Linn.; but from its elongation and slenderness it belongs to that series of the genus *Lecanium* of which Signoret takes *L. persicæ* as the type. It differs, however, from all described species of that series. *L. elongatum*, Sign., is much larger, is rugose at the edges, and has, moreover, eight-jointed antennæ; so also has *L. genistæ*, Sign. The long, narrow abdominal cleft of *L. chirimoliæ*, the sharp adjacent dorsal lobes, and the short spiracular spines seem to be specific distinctions; and the distance of the antennæ from the cephalic extremity is also peculiar. I am not aware whether the chirimoya is a plant indigenous to Fiji: if it has been imported there from Central America it has probably brought its Lecanid with it.

Group COCCIDINÆ.

Subdivision ACANTHOCOCCIDÆ.

Genus SOLENOPHORA,\* gen. nov.

Female insect constructing a test which is prolonged, either at or near the abdominal extremity, in a hollow pipe or spout; apodous when adult; anal tubercles present and prominent.

The clearly distinct anal tubercles of both the insects about to be described fix the position of this genus in the *Acanthococcidæ*. In one species the pellicle of the second stage is employed as part of the adult test, as in the Lecanid genus *Lecanochiton*, mihi; but, as this does not seem to be the case in the other species, I cannot found a generic distinction on it. In *S. fagi* the female of the second stage is undoubtedly apodous, like the adult; and probably this is the case also with *S. corokiæ*; but I have not been able to satisfy myself entirely as to this latter, and therefore have left this character also out of the generic description. Should the two insects, however, hereafter prove to be equally apodous in the second stage, the character will become generically important.

The tube or spout which forms the peculiar feature of this genus is rather a puzzle. I can only guess that it has some sexual function for facilitating the access of the male; yet it is not easy to see the necessity for it, even for that purpose. For many other Coccids in the genera—for example, *Mytilaspis*, *Ctenochiton*, *Planchonia*—are just as well shut in and protected as *Solenophora*, and yet have no such peculiar appendage. But, if it has not a sexual function, it is not easy to make out what other object the tube can serve. In the Australian group of the Brachyscelidæ the males of some species are found to inhabit small pipes springing from the galls formed by the adult females: sometimes a dozen or more are attached to a single gall. But in *Solenophora fagi* the male pupa inhabits a felted cylindrical sac quite distinct from the female test; the presence of the tube is therefore not clearly intelligible.

*Solenophora fagi*, sp. nov. Plate V., figs. 1–18.

Adult female brown, or sometimes inclining to purple; somewhat pegtop-shaped; length about  $\frac{1}{10}$  in.; the median region very convex dorsally, with somewhat flattened edges; ventral surface flat. Covered by a shield or test of an elongate-conical form, or limpet-shaped, of which the apex is occupied by the pellicle of the second stage, the remainder being waxy; colour of test brownish-yellow, the pellicle darker and rather shiny; test marked with very fine concentric horizontal lines, and a few vertical striæ, of which four are usually whitish;

\* Gr. σωλήν = a tube or spout.

length of test about  $\frac{1}{14}$  in. ; edges somewhat incurved below, so that the insect is partially enclosed. In the majority of cases (though there are specimens without it) when the test is viewed sideways there is seen to project from it, a little above the abdominal extremity, a kind of curved tube or pipe, like the spout of a teapot, hollow and open at the end, and bent downwards. Where this tube is absent the edges of the test at the abdominal extremity are slightly turned upwards, leaving a small space under the test. The female at first fills the test, but at gestation shrivels up ; it contains usually a large number of eggs. Insect elliptical in the cephalic and thoracic regions, and smooth, tapering with inconspicuous segments to the abdominal extremity, which is rounded with a short, roundly-conical prolongation ; the anal tubercles spring from the ventral surface, near the base of this projection, close to the anogenital ring, and are therefore not visible when the insect is viewed dorsally. Tubercles short, rather slender, each bearing a short strong seta. Insect entirely apodous. Antennæ reduced to mere irregular rings with a few short hairs. Mentum dimerous. Anogenital ring simple, with six short hairs. Spinnerets of two kinds—some circular orifices, others cylindrical tubes. They are most numerous at the edges and at the abdominal extremity.

Female of the second stage red or reddish-brown, somewhat more elongated than the adult, rather convex ; length about  $\frac{1}{35}$  in. ; in the beginning of this stage it is slightly covered with loose yellow cottony secretion, which later on becomes a felted, semi-waxy, white test. Entirely apodous. Antennæ atrophied, being reduced to a single-jointed conical process, very short, bearing a few hairs at the tip. Mentum dimerous. Anal tubercles short, but more conspicuous than in the adult, not being covered by any projection of the abdomen : each bears a short seta and a strong spine. Spinnerets of two kinds—some simple circular orifices, others slightly protuberant, double, or figure-of-8 ; the former all over the dorsum but not numerous, the latter very numerous at the edges and on the abdominal region ; from these spinnerets spring some short, white, curly tubes. The female in this stage, having no feet, cannot move ; in changing to the adult form the white thin test gradually breaks away, leaving the pellicle to form the apex of the adult test, as before stated.

Larva reddish-yellow, elliptical, flattish ; length about  $\frac{1}{10}$  in. ; segmented ; active. Anal tubercles very short, setiferous. Antennæ of six short subequal joints ; no hairs except on the last joint. Feet rather thick ; tibia shorter than the tarsus ; upper and lower digitules slender knobbed hairs. On the edge of the body is a row of the large, slightly-protuberant figure-of-8 spinnerets, and also a row of small circular



orifices, and on the dorsum there are four other longitudinal rows of small circular spinnerets. Mentum dinerous.

Male pupa entirely enclosed in a cylindrical yellowish sac of closely-felted secretion. Length of sac about  $\frac{1}{16}$  in.; length of pupa about  $\frac{1}{25}$  in. Pupa red, apodous, elongated, narrow, segmented, the segments obscure except the last four or five; exhibiting at the abdominal extremity two short anal tubercles.

Adult male unknown. I have made unsuccessful efforts to hatch any from several specimens of the pupa.

*Hab.* In New Zealand, on *Fagus*, various species. As yet only from Capleston, Inangahua, where it seems to be plentiful.

This is in several respects a curious and interesting insect. The employment of the second pellicle in the adult test is a character not hitherto reported of any member of the group *Coccidine*. From the absence of the feet in the second stage it results that the insect is not likely to be found far from the spot on which it emerged as a larva. The larvæ of most Coccids prefer to seek their sustenance, if not on the leaves, on the young shoots of a plant; accordingly, I understand from Mr. Raithby, who originally found the species, that individuals are rarely found on wood more than a year or so old. It must happen also that two or three larvæ congregate together about the time of their metamorphosis, and the resulting second-stage females, not being able to get away, change also to the adult form in the same place; and so we find now and again two or three adults crowded together or piled on each other. In a specimen of a heap of this kind in my collection the lowest insect has excreted a small quantity of dark-pink cotton round the edges of its test: as I have not observed this in any other amongst some scores of individuals examined, I cannot take it as normal. As regards the spout-like tube, it is to be noted that the prolongation of the female abdomen would, in the test, pretty nearly correspond to the inner opening of the tube.

***Solenophora corokiæ*, sp. nov.** Plate V., figs. 19–24.

Insect constructing a pear-shaped, smooth, waxy test, which is prolonged at the abdominal extremity in a short tube, either straight or slightly turned upwards: this tube is at the extremity itself, and not a little above it as in the last species. Colour of test brownish-yellow; length about  $\frac{1}{15}$  in. The second pellicle does not appear to be employed in the test.

Adult female brown; length about  $\frac{1}{20}$  in.; peg-top-shaped, the cephalic and thoracic regions large, abdomen tapering to the anal tubercles, which are of moderate size and setiferous;

the tubercles are visible in dorsal view, as the abdomen is not produced cylindrically as in *S. fagi*. Feet entirely absent. Antennæ atrophied, simply irregular rings bearing hairs. Mentum dimerous. Spinnerets of two kinds, some simple and circular, others figure-of-8: these last seem to be more numerous, especially on the dorsal thoracic region, than in *S. fagi*.

Female of second stage, larva, and male not observed.

*Hab.* In New Zealand, on *Corokia cotoneaster*, a twisted shrubby plant in river-beds, Reefton district.

The distinction between this and the last species, at least as far as the adult female is concerned, is marked by the form of the test, the position of the tube, and the absence of the second pellicle.

### Genus RHIZOCOCCUS, Signoret.

*Rhizococcus totaræ*, sp. nov. Plate VI., figs. 1–11.

Adult female naked, dark-brown, elongated, at first elliptical but later somewhat shrivelled: length about  $\frac{1}{2}\frac{1}{5}$  in.; cephalic region proportionately large, smooth; body tapering to the abdominal extremity with conspicuous segments; anal tubercles distinct, but small, with very short setæ. Antennæ of six (frequently five) subequal, rather thick, joints, the last bearing several longish hairs. Feet normal; tibia shorter than the tarsus; all the digitules are fine hairs. Anogenital ring simple, with eight hairs. On the edge of the body a row of short, strong, conical spines.

Female of second stage usually red, sometimes green or yellow; elliptical, convex above; general form normal of the genus, segmented; length about  $\frac{1}{4}\frac{1}{5}$  in.; there is a slight white meal on the surface. Anal tubercles conspicuous, setiferous. Cephalic segment rather large. Antennæ of six subequal joints, the last bearing some hairs. Feet rather thick. Mentum dimerous. On the edge of the body a number of strong conical spines, from which spring very short curly tubes.

Larva yellow, flattish, elliptical, segmented; length about  $\frac{1}{8}\frac{1}{5}$  in. Anal tubercles not very conspicuous, setiferous. Cephalic segment large. Antennæ proportionately long, with six subequal joints, the last hairy. Feet also long; femur rather slender. On the edge a number of strong conical spines, which give to the margin a toothed appearance.

Male unknown.\*

*Hab.* In New Zealand, on *Podocarpus totara*, and sometimes on *Fagus menziesii*, near Reefton.

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\* Since this paper was written I have found the male of *R. totaræ*. The sac is snowy-white, of very loose texture. The description will be given in a future paper.

The size of the cephalic segment in this insect is peculiar. Had there been any sign of a sac in the adult I should have placed the species in the genus *Eriococcus*, near *E. hoheriæ*, mihi, which also has a very large cephalic segment; but the adult exhibits no cottony sac. The variable antennæ are abnormal. Signoret's original genus *Rhizococcus* was formed to include *R. gnidii*, a European insect having antennæ of seven joints: I have added *R. celmisia* (1883) and *R. fossor* (1883), with antennæ of six joints; and I now include *R. totaræ*, where the joints are often five, for in all other respects—form, tubercles, anogenital ring, absence of sac, &c.—it agrees perfectly with *Rhizococcus*.

***Rhizococcus pulchellus*, sp. nov.** Plate VII., figs. 1-5.

Adult female green, or sometimes dull-red or yellowish in colour; general form elliptical; length about  $\frac{1}{15}$  in. as a rule, but some specimens  $\frac{1}{12}$  in.; segmented, the segments not very distinct; body longitudinally corrugated with four shallow depressions; covered with many conical spines, from which spring on the dorsum short glassy cylindrical tubes, giving it a numerously-bristled appearance, and on the edges much longer tubes which form a fringe. Antennæ of seven subequal joints. Feet normal of the genus. Anal tubercles small, setiferous; anogenital ring with eight hairs.

Female of second stage bright-green in colour, longitudinally corrugated as the adult, the elevated portions of a lighter green than the depressions; elliptical, flattish, segmented; length about  $\frac{1}{15}$  in. The ventral surface is convex, the insect forming a shallow depression in the leaf it lives on. All the segments bear very numerous, large, conical spines, from which spring dorsal and marginal glassy white tubes, longer than those of the adult, so that the insect appears studded with silvery spikes and with a long fringe; the marginal spines are a good deal larger than the dorsal ones. Antennæ of six joints, the fourth and fifth rather shorter than the rest. Feet rather large; on the trochanter a long seta; digitules slender, but the lower pair rather more dilated at the end than the upper. Mentum dimerous; there appear to be four rostral setæ. Anal tubercles rather large, setiferous, with a strong spine near the end.

Larva elliptical; colour green with brownish patches; length about  $\frac{1}{30}$  in.; dorsum flat, slightly corrugated longitudinally; ventral region convex. Antennæ of six joints. Segments bearing spines, but less numerously than in the later stages; the spines are arranged in eight longitudinal rows (including the two marginal series), and bear glassy tubes. On the last four abdominal segments there are also rows of fine small spiny hairs—dorsally, two in the middle of each

segment; ventrally, six on each segment. Anal tubercles normal.

Male unknown.

*Hab.* In New Zealand, on various species of *Fagus*—*F. fusca*, *F. menziesii*, *F. cliffortioides*, Rimutaka Hills near Wellington, Caplestone, Reefton, and Picton; almost always on the leaves.

This is an extremely pretty insect, especially in the second stage, when the bright-green of the body contrasted with the silver fringe and dorsal tubes makes it a very attractive microscopic object. It is not likely to be mistaken for any other species. Unfortunately the bright colours fade after death, and specimens in the cabinet lose much of their natural beauty.

***Rhizococcus maculatus*, sp. nov.** Plate VII., figs. 6–12.

Adult female sub-globular; colour green or brown; length about  $\frac{1}{16}$  in.; segmented, but the segments indistinct; naked. Anal tubercles rather large, setiferous. Antennæ of six rather thick subequal joints, the last with some shortish hairs. Feet rather thick; tibia shorter than the tarsus; upper digitules fine knobbed hairs, lower pair rather long and largely dilated at the ends; on the trochanter a long seta. Mentum dimerous. Anogenital ring simple, with eight hairs. No spines on the dorsum, but some slender conical spines on the edges.

Female of second stage very light green, spotted on the dorsum sparsely and irregularly with largish patches of intense black; convex, elliptical, ventral region slightly concave; length about  $\frac{1}{20}$  in.; quite smooth and shiny, the segments very obscure. Anal tubercles very small, and not visible in dorsal view, being hidden by the convexity of the abdomen. The margins bear several conical spines, not set very closely together, from which spring longish, slender, glassy tubes. On the dorsum there are four longitudinal rows of slender spines, two median and two others halfway to the edges. Antennæ of six subequal joints. Feet normal; lower digitules short.

Larva yellow or light-green; flattish; elliptical; segmented, with obscure segments; length about  $\frac{1}{10}$  in. Anal tubercles conspicuous, setiferous. Antennæ hyaline, with five subequal joints, the last bearing several long hairs. Feet hyaline, rather thick; lower digitules very short. Mentum dimerous. On the margin is a row of conical spines; and on the dorsum are twenty conical spines, larger than the marginal ones and arranged as follows: two pairs at the cephalic extremity, four in a row just above the rostrum, and twelve in four rows on the anterior abdominal segments.

Male unknown.

*Hab.* In New Zealand, on *Fagus cliffortioides*, Reefton district.

The peculiar appearance of the second stage in this species, its bright-green colour with black spots, and its smooth skin, render it easily recognisable. The arrangement of the spines, &c., is of course not to be clearly made out until the insect has been treated with caustic potash or some other reagent.

Genus *ERIOCOCCLUS*, Targioni-Tozzetti.

I adhere to the plan by which this genus is separated from *Irhizococcus* by the construction of a cottony sac. It will be seen presently that, until further inquiry, I leave also separate the genus *Gossyparia*, in which the distinction has been made to depend only on the quantity of cotton excreted. Such a distinction will not, perhaps, be always retainable, as observation of Coccids in many countries extends; but the genus *Eriococcus* will, I think, be permanent.

*Eriococcus raithbyi*, sp. nov. Plate IX., figs. 1-18.

Sac of adult female orange-yellow, rather lighter-coloured at the extreme abdominal end; elliptical; convex; very closely felted, smooth and solid in appearance; length averaging about  $\frac{1}{16}$  in.

Sac of male pupa orange-yellow, lighter-coloured at the abdominal end; cylindrical, slightly convex, narrow; closely felted, like that of the female; length about  $\frac{1}{14}$  in.

Adult female dark-yellow or red, becoming darker after gestation; at first almost filling the sac, afterwards gradually shrivelling as she becomes void of eggs. Before gestation elongated, ovate, segmented, convex; anal tubercles small but distinct, setiferous; anogenital ring with eight hairs; at the base of each tubercle are three or four spines, and another spine near the tip. Antennæ of seven subequal joints, the third and seventh being a little the longest; a few hairs on each joint. Feet with rather thick femur; on the trochanter a long seta; tibia and tarsus slender, tibia shorter than the tarsus; digitules four, strong hairs with largely-dilated ends. Mentum dimerous (?). On the dorsum a number of small spinnerets—some simple circular orifices, others very minute spiny hairs. On the edges of the segments some very small fine hairs.

Female of second stage yellow, elliptical, convex, segmented; anal tubercles conspicuous, setiferous. Antennæ of six joints the third and sixth a good deal longer than the others. Feet rather short and slender. On the edges many spiny hairs, stronger than those of the adult. There is a thin white meal on the body.

Larva orange-yellow; elliptical; flattish; segmented;



length about  $\frac{1}{80}$  in. Antennæ of six subequal joints, the last bearing three or four long hairs. Mentum dimerous. Dorsum covered with a great number of small fine spines, and at the edges two rows of strong conical spines. Anal tubercles conspicuous, setiferous.

Adult male orange-yellow, the thorax darker than the abdomen. Abdomen slender, ending in a short genital spike, with the usual curved appendage of the genus; last segment bearing two longish setæ, from which spring very long white cottony "tails." Eyes four, two dorsal and two ventral; ocelli two. Haltere long and slender, with one long seta. Antennæ of ten joints—the first very short; second twice as long and rather thick, dilated at the end; third to eighth slender, the third very long, the rest gradually decreasing; ninth very thick, short and round; tenth also thick, but rather longer than the ninth: all the joints bear numerous hairs. Feet normal; digitules fine knobbed hairs.

*Hab.* On *Fagus menziesii* in New Zealand. I have pleasure in attaching to this species the name of Mr. Raithby, who has furnished me with many specimens.

This, in every respect but one, possesses the characters of the genus *Eriococcus*. The seven-jointed antenna of the female is abnormal, but I am not inclined to remove it from the genus on that account alone. In the group *Dactylopida*, as the insects composing it do not exhibit conspicuous anal tubercles, and excrete only thin cotton or meal, it is necessary to lay stress upon some character such as the joints of the antennæ. But in the *Acanthococcidæ* the presence or absence of a sac is sufficiently distinctive; and as in the genus *Rhizococcus* I have placed *R. totaræ*, with often only five joints in the antennæ, so now I see no valid reason for excluding this new insect from *Eriococcus*, although the normal number of joints in that genus is six. As to its specific position, the character just mentioned, and also the form of the male antenna, serve to separate it from others of the genus. The female sac may be distinguished from that of *E. multispinus* by its smoothness and close texture; the male sac differs also from that species in colour as well as in the closeness of its felting. A further character, separating it from *E. multispinus* and also from *E. pallidus*, is the absence of large conical spines on the dorsum of the adult.

#### Genus GOSSYPARIA, Signoret.

Adult males not entirely covered by a sac, but excreting a cottony mass, which is thickest beneath them, and either very thin or absent altogether over the dorsum; anal tubercles conspicuous; feet and antennæ retained.

The distinction made by Signoret between this genus and

*Eriococcus* depends simply upon the quantity of cotton excreted. In *Eriococcus* this is sufficient to form a complete envelope, and the female insect is not visible until the cottony mass has been torn away from it; in *Gossyparia* a certain portion, or the whole, of the dorsal region is exposed. I confess that it seems to me likely that these two genera will have to be, some day, united. The distinction hitherto relied upon does not in any case seem altogether satisfactory. Between *Eriococcus* and *Nidularia*, Sign. (a genus closely resembling *Gossyparia* in outward appearance), there is, besides the difference in the cottony mass, an entirely organic distinction, for *Nidularia* loses its feet and antennæ. Between *Eriococcus* and *Rhizococcus* there is the distinction that the latter constructs no cottony mass at all. These are sufficient characters for separation. But between *Eriococcus* and *Gossyparia* it is only a question of quantity. And as observation is extended numerous links are sure to be found in which the quantity of cotton will be extremely various. The insect about to be described seems to be one of these links. It is not entirely enclosed, like *Eriococcus raithbyi*; it is not quite bare on the dorsum, like the European *Gossyparia ulmi*. I shall leave it in the genus *Gossyparia*, because it certainly has not always what one could call a regular "sac;" but some day the whole genus will probably have to be merged in *Eriococcus*.

***Gossyparia cavellii*, sp. nov.** Plate VII., figs. 13-22.

Adult female stationary, dark-purple in colour, semi-globular, averaging about  $\frac{1}{10}$  in. in diameter; resting on a cushion of yellowish or greyish cotton, with filaments of the same more or less sparsely covering the dorsum; sometimes the body of the insect is quite clearly visible through the threads, at others it is scarcely to be seen. When crushed, the insect stains the fingers a rich-crimson colour. Body segmented, but the segments are indistinct when at full age. Antennæ of six subequal joints. Feet very short; coxa and femur thick, with a somewhat large trochanter on which there is one rather long seta; tibia shorter than the tarsus; all the four digitules are knobbed hairs. Anal tubercles moderate, each bearing at the end two rather short setæ, and with a spine at the base. Anogenital ring with eight hairs. Spiracles circular, funnel-shaped. Very numerous short conical spiny spinnerets on each dorsal segment, most numerous near the edges; interspersed with these are simple circular orifices, which are sparse on the median dorsal region. Mentum dimerous, bearing a few short hairs at the tip.

Female of second stage active, naked; dark-crimson in colour just before the metamorphosis, but red with yellow edges at the beginning of this stage; at first elliptical, but at

last subcircular; convex, distinctly segmented; length about  $\frac{1}{30}$  in. Antennæ of six subequal joints. Feet as in the adult, but the knobs of the digitules are larger. Anal tubercles conspicuous, with a short pencil of setæ between them. A row of very strong spines runs round the edge, and on the dorsum there are four other longitudinal rows—two close together down the median region, the two others half-way to the edges; the marginal spines often bear glassy tubes.

Larva active, naked; at first yellow or orange, and later a deep crimson-red; elliptical, slightly convex; length about  $\frac{1}{80}$  in. Antennæ of five subequal joints, rather thick; the last joint bears several long hairs. Feet rather thick. Rows of spines large and conspicuous, arranged as in the second stage.

Male pupa enclosed in a cylindrical, loosely-felted, cottony sac, which is open at the posterior end. Length of the sac about  $\frac{1}{16}$  in. Colour of sac pure-white.

Male orange-yellow, the thorax darker than the abdomen. Length about  $\frac{1}{25}$  in., with the usual pair of very long white cottony "tails" from the last abdominal segment. Antennæ of ten joints, each shortening from the head to the tip. Abdominal spike presenting the usual curved appendage noticeable in *Acanthococcidæ*.

*Hab.* In New Zealand, on *Fagus menziesii*, Rimutaka Mountains, near Wellington, and Capleston, near Reefton. The adults and the females at the close of the second stage affect the axils of the twigs. The larvæ and females of the early second stage, as also the male sacs, are found principally on the leaves. The adult, partly covered with its cotton, is usually inconspicuous, and not easy to find.

The absence of anything like a sac, such as that usually presented by *Eriococcus*, distinguishes this species from any yet described in this country; and it is not at all like any foreign species. The second stage may be easily mistaken for *Rhizococcus*. The male presents no special features; but its sac may be distinguished from those of *E. multispinus*, *E. raithbyi*, &c., by its purely-white colour, and from *Solenophora fagi* by its loose open texture. The rich-crimson colour of the female when crushed is very fine. I have pleasure in attaching to this species the name of Mr. Cavell, of Inangahua, who has been assiduous in collecting and studying Homoptera in that district.

The various kinds of *Fagus* trees have, as this paper shows, furnished me so far with six species of Coccids, all of which will, I believe, stand the test of careful scrutiny as distinct species. Two of them—*Solenophora fagi* and *Dactylopius obtectus*—are of somewhat special interest, and the others are in their way also curious. I believe that there is also a Lecanid

peculiar to *Fagus*; at least, I have taken, at Picton, a blue *Lecanium* on *F. cliffortioides* which seems entirely new; but, having never seen more than one specimen, I refrain from attempting to classify it.

# Subdivision DACTYLOPIDÆ.

## Genus DACTYLOPIUS, Costa.

**Dactylopius cocotis**, sp. nov. Plate IV., figs. 16–24.

Adult female red, covered with much cottony secretion; broadly elliptical; convex; segmented, the segments conspicuous; active; length about  $\frac{1}{4}$  in. Anal tubercles not visible in dorsal view, but they can be made out ventrally. They are very small, and each bears a few short setæ. Anogenital ring compound, with six hairs. On each segment of the body are several short fine hairs, appearing at the edges like little tufts. Antennæ of eight joints—the second the longest; fourth, fifth, sixth, and seventh the shortest, and equal: all the joints bear a few hairs. Feet with rather thick femur; upper digitules long fine knobbed hairs, lower pair very short fine hairs; femur, tibia, and tarsus hairy; and on the trochanter is one long seta. Mentum dimerous.

Second stage of female similar to the adult, but a good deal smaller, and with antennæ of seven joints.

Larva red, elongated, elliptical, distinctly segmented, active; length about  $\frac{1}{2}$  in. Cephalic extremity distinctly depressed. Antennæ rather thick, with six subequal joints. Feet and digitules as in adult. The anal tubercles are very small and inconspicuous, each bearing a seta. At the edge of each segment are three or four hairs.

Male unknown.

*Hab.* In Fiji, on *Cocos nucifera* (cocoanut). Mr. Holmes tells me that it lives “on base of fronds while white and not fully developed.”

This insect seems intermediate between the two New Zealand species *D. calceolaria* and *D. alpinus*. It is smaller, and has a greater quantity of cottony and mealy secretion than the former, and it has not the rich-red tint of the latter when crushed. In the antennæ and digitules, and absence of spinneret tubes or other appendages, it likewise differs from both.

**Dactylopius calceolaria**, mihi, “Scale-Ins. of N.Z.,” p. 100.

On some pieces of sugar-cane sent to me by Mr. Holmes from Fiji were several insects which I cannot distinguish from *D. calceolaria*. They affect, apparently, chiefly the “sheathing base” of the leaves, in the same way as in New Zealand they are found in a similar position on *Phormium tenax*. Some

small caterpillars (lepidopterous?) were amongst the specimens, and Mr. Holmes says that they seem to "eat the Coccids."

**Dactylopius arecæ**, sp. nov. Plate VIII., figs. 1-6.

Adult female yellowish-brown, sometimes reddish, covered with a brownish-yellow coating of meal, which is not, as usual, cottony, but granular and loosely attached; elliptical; convex; segmented; abdominal extremity rather truncate; length about  $\frac{1}{11}$  in. On the segments are many small fine hairs. Anal tubercles very inconspicuous, each bearing four or five longish hairs. Anogenital ring compound, with six hairs. Antennæ of eight joints—the last the longest, the first and second very short. Feet slender; all the joints hairy; on the trochanter a long seta; upper and lower digitules fine hairs; tibia slightly dilated at the tip, and bearing there a short stiff spur. Mentum dimerous, with several spiny hairs at the tip. On the segments of the body are a large number of circular simple spinneret-orifices.

Second stage of female similar to the adult, but smaller, with antennæ of seven joints, and a tibia shorter than the tarsus.

Larva and male unknown.

*Hab.* In New Zealand, underground, on roots of *Areca sapida* (nikau palm); as yet only from Wellington. It differs from the other New Zealand subterranean species, *D. poæ*, in the granular character of the mealy secretion, and in the spur of the tibia.

**Dactylopius adonidum**, Linn.

This species, not hitherto reported from New Zealand, occurs here in the hothouses and stoves of Government House, Wellington. At least, the characters belonging to it appear to be so close to those of the common European "mealy-bug" that I do not attempt to separate it. There are several species in Europe so nearly resembling *D. adonidum* that it is extremely difficult to identify them—*e.g.*, *D. citri*, Boisduval, *D. cyperi* or *D. pteridis*, Signoret, &c. All of them differ from the New Zealand species *D. glaucus* and *D. calceolaria* (besides their colour and size) in the presence of conspicuous marginal filaments.

**Dactylopius poæ**, mihi, "Scale Ins. of N.Z.," p. 101.

In its natural state, on roots of tussock-grass, underground, this insect excretes only a thin white mealy cotton, visible in small patches about the roots. But, having collected this winter some thirty or forty specimens, and placed them in a glass tube, I was surprised to find that they filled the tube



with abundant cotton. I turned them out into a deep watch-glass and brushed the cotton away. After a few days they surrounded themselves with another thick mass, in which they are now entirely hidden.

**Dactylopius aurilanus**, sp. nov. Plate VIII., figs. 7–18.

Adult female slightly elongated, nearly globular; of a rich dark-purple colour, bearing on the dorsum a longitudinal band of bright golden-coloured meal, with small patches of similar meal often visible at the edges. In alcohol or potash it produces a rich-purple tint, and if crushed in the fingers stains them dark-red. The eggs, which are also purple, are laid in a mass behind the insect, in a thin white cottony web, the mass having thus a general dark-grey appearance. Body obscurely segmented. Length about  $\frac{1}{11}$  in. Antennæ usually of eight joints, often of seven; in the former case the fourth, in the latter the third, joint is the longest, the rest subequal, except the last, which is fusiform, and nearly equal to the longest: all the joints have a few hairs, the last bearing several. Feet normal, not very slender; upper digitules long fine knobbed hairs, lower pair slender with dilated ends. Anal tubercles very inconspicuous, each bearing one long seta and a few very short hairs. Anogenital ring compound, with six hairs. Spinnerets not numerous, chiefly situated on the median dorsal region; mostly simple circular orifices, with some short fine spiny tubes amongst them. On the cephalic region are a few short hairs.

Female of second stage rich-purple in colour, bearing longitudinal rows of golden-coloured meal in detached patches: at the commencement of this stage, however, the meal is nearly white. The rows are arranged as follows: one along the middle of the dorsum, one along each edge, and two others intermediate; five in all. The meal is in detached lumps or masses, which permit the purple body to be seen between them, giving a tessellated appearance to the insect. Body obscurely segmented; convex above; outline elliptical; length about  $\frac{1}{24}$  in. Anal tubercles inconspicuous, each bearing a seta, the meal on which protrudes farther than in the other patches; between them the hairs of the anogenital ring are usually coagulated in a pencil of white cotton. Anogenital ring with six hairs. Antennæ of seven joints, all hairy, the last bearing several hairs and two short terminal spines. Feet as in the adult. Spinnerets fairly numerous, all of them simple circular orifices.

Larva dull-purple, covered with thin white meal; flattish; elliptical; very active; length about  $\frac{1}{50}$  in. Mentum rather large, dimercous. Anal tubercles conspicuous. Antennæ of six joints, the last fusiform, a good deal the longest, and bear-

ing two short terminal spines. Feet and digitules as in the adult, but the tibia is shorter than the tarsus.

Male pupæ inhabiting white cottony masses, very small, intermingled with the meal and egg-masses of the females; they do not seem to form regular sacs.

Adult male brown in colour, covered with thin whitish meal; length about  $\frac{1}{20}$  in.; general form normal of the genus, with slender thorax and abdomen and short spike; from the last abdominal segment spring two not very long setæ, bearing cotton, and forming the usual "tails." Antennæ with ten rather thick joints, all subequal in length, the second being a good deal thicker than the rest; all the joints bear several short hairs. Feet slender, hairy; digitules fine hairs. Eyes four, two dorsal, two ventral; no dorsal ocelli, but at each side there is one, on the edge.

*Hab.* In New Zealand, on *Araucaria bidwillii*, at Auckland, and spreading from that to *Araucaria excelsa* and other adjacent conifers. My specimens are from the garden of the late Mr. Justice Gillies, where the insect has been plentiful. It cannot be looked on as indigenous to New Zealand: in all probability it is an importation from Australia; Queensland may be perhaps the original locality.

If left undisturbed, *D. aurilanatus* seems to smother the plant with its numbers of adults, pupæ, and egg-masses, and soon renders it unsightly. In a warm climate, I fancy, it would spread rapidly, as the eggs are very numerous and the larvæ very active.

The appearance of this insect is peculiar, and in a specimen cleared from cotton not without beauty, from the dark-purple of the body contrasted with the bright-golden colour of the excreted meal, and the mode of arrangement of the latter; and I think it cannot be confounded with any other species of the genus. The fact that individual females may be found with either seven or eight joints in the antennæ is abnormal; but a similar discrepancy is reported in *Dactylopius bromeliæ*, Bouché (Signoret, "Essai," p. 344), a South American species.

***Dactylopius obtectus* sp. nov.** Plate VI., figs. 12–21.

Adult female sheltering itself beneath a leaf- or bud-scale of the food-plant; excreting in this position much white cotton, in which the eggs are laid. Colour red; body elliptical, convex, segmented, shrivelling after gestation; length about  $\frac{1}{30}$  in.; the last segment of the abdomen is slightly produced cylindrically, with inconspicuous setiferous anal tubercles. Mentum dimorous, with several short hairs at the tip. Antennæ of eight joints, subequal except the last, which is irregularly fusiform and longer than any two others. Anogenital ring compound, with six hairs. Spinnerets scattered all over the body

—some simple circular orifices, others small cylindrical tubes.

Female of second stage and larva unknown.

Male unknown.

*Hab.* In New Zealand, on *Fagus fusca* (black-birch), near Reefton; apparently only on the twigs.

The employment of a bud-scale as a covering by this insect in the adult state is peculiar, and abnormal in the genus. The *Dactylopii* are as a rule either active and almost naked even during gestation, or simply surround themselves with cottony secretion. The scales of *Fagus fusca* are very small, red in colour, and triangular, and their concavity on one side forms a most convenient shelter for this insect, which is only to be detected from the small fringe of cotton which usually protrudes from beneath the edges of the scale—in fact, it would be scarcely noticed in most cases. The prolongation of the abdomen is a character which distinguishes *D. obtectus*, apart from its mode of concealment, from other species of the genus. I am indebted to Mr. Cavell for this species.

#### Subdivision MONOPHLEBIDÆ.

##### Genus CÆLOSTOMA, Maskell.

*Cælostoma assimile*, sp. nov. Plate IX., figs. 19–24.

Female of the second stage covered by a hard waxy test of irregular shape. Insect globular, reddish, smooth, very obscurely segmented; diameter about  $\frac{1}{10}$  in. in the specimens observed; filling the test. Antennæ thick, conical, very short, with four joints. Feet absent. Rostrum and mentum very large; mentum long, sharply conical, trimerous. Skin covered with a great number of circular spinneret-orifices of two sizes, all simple. Tracheæ very large, ending in sixteen vasiform spiracles. At the abdominal extremity a large brown patch, in which is the anogenital simple ring; and there is a large internal tubular (honey-dew?) organ, with a group of circular glands at its interior end, and a ring of similar glands half-way along it.

Adult female, larva, and male not observed.

*Hab.* In New Zealand, on *Fagus* sp., Reefton district.

Although I have only the second stage of this insect, it resembles in so many particulars *C. zealandicum*, mihi, that I have no hesitation in fixing its generic position. In size it is much smaller than the average of that species; at the same time, I have seen on the same twig waxy tests of *C. zealandicum*, varying from the size of a large pea down to that of a large pin's head; and possibly those of *C. assimile* may also vary considerably. This insect is quite distinct, in the absence of the feet, in the four-jointed antennæ, and in the very large

rostrum and mentum of the second stage. All the tests which I have seen are in the axils of the twigs of *Fagus*. Probably the adult female, when discovered, will prove to be a dark-red, naked, wandering insect, of much the same form as *C. zealandicum*. I have on one occasion seen a specimen from the forests of Otago (since lost) which had several large papillæ on the dorsal segments, and was otherwise similar to, though smaller than, *C. zealandicum*: this might perhaps be the adult form of *C. assimile*.

The foregoing paper includes all the species of Coccids which I am at present able to describe. I have, in addition, in my collection some insects from South Australia—a *Dactylopius*, a *Kermes*, two or three *Eriococci*, &c., and a most extraordinary Coccid of gigantic size (nearly an inch long and half an inch high); but these are, as to their descriptions, the property of my friend Mr. F. S. Crawford, of Adelaide, who tells me that he proposes to publish them some day. I hope that he will be able to do so before long.

#### INDEX TO PLATES IV.—IX.

##### PLATE IV.

- Fig. 1. *Mytilaspis grisea*, pygidium of female.
- Fig. 2. *M. pallens*, pygidium of female.
- Fig. 3. " male and female puparia on leaf.
- Fig. 4. " male and female puparia.
- Fig. 5. *Lecanium chirimoliae*, female, dorsal view.
- Fig. 6. " female, ventral view.
- Fig. 7. " eye of female.
- Fig. 8. " rostrum and mentum of female.
- Fig. 9. " abdominal lobes.
- Fig. 10. " antenna.
- Fig. 11. " foot.
- Fig. 12. " claw and digitules.
- Fig. 13. " markings of skin.
- Fig. 14. " larva, dorsal view.
- Fig. 15. " antenna of larva.
- Fig. 16. *Dactylopius cocotis*, adult female, dorsal view.
- Fig. 17. " antenna of female.
- Fig. 18. " foot.
- Fig. 19. " extremity of abdomen.
- Fig. 20. " anogenital ring.
- Fig. 21. " larva, dorsal view.
- Fig. 22. " antenna of larva.
- Fig. 23. " extremity of abdomen of larva.
- Fig. 24. " foot of larva.

##### PLATE V.

- Fig. 1. *Solenophora fagi*, male and female tests on twig.
- Fig. 2. " female test, upper view.
- Fig. 3. " " under view, with female.
- Fig. 4. " " side view.
- Fig. 5. " male sac.
- Fig. 6. " adult female, dorsal view.

- Fig. 7. *Solenophora fagi*, extremity of abdomen of female.  
 Fig. 8. " atrophied antenna.  
 Fig. 9. " female of second stage, dorsal view.  
 Fig. 10. " " antenna.  
 Fig. 11. " " anal tubercles.  
 Fig. 12. " " spinnerets.  
 Fig. 13. " larva, dorsal view.  
 Fig. 14. " antenna of larva.  
 Fig. 15. " foot of larva.  
 Fig. 16. " spines and tubes of larva.  
 Fig. 17. " male pupa.  
 Fig. 18. " " abdominal extremity.  
 Fig. 19. *S. corokiae*, female tests on twig.  
 Fig. 20. " female test, upper view.  
 Fig. 21. " " side view.  
 Fig. 22. " adult female, dorsal view.  
 Fig. 23. " anal tubercles and anogenital ring.  
 Fig. 24. " spinnerets.

PLATE VI.

- Fig. 1. *Rhizococcus totaræ*, insects on leaves and twig.  
 Fig. 2. " adult female, dorsal view.  
 Fig. 3. " female of second stage, dorsal view.  
 Fig. 4. " larva, dorsal view.  
 Fig. 5. " antenna of adult female.  
 Fig. 6. " foot of adult female.  
 Fig. 7. " marginal spines of adult female.  
 Fig. 8. " anogenital ring.  
 Fig. 9. " antenna of female of second stage.  
 Fig. 10. " spines and tubes of female of second stage.  
 Fig. 11. " antenna of larva.  
 Fig. 12. *Dactylopius obtectus*, insects under shelter of twig.  
 Fig. 13. " insect in shelter, overturned.  
 Fig. 14. " adult female, dorsal view.  
 Fig. 15. " abdominal extremity of female.  
 Fig. 16. " anogenital ring.  
 Fig. 17. " antenna.  
 Fig. 18. " foot.  
 Fig. 19. " claw and digitules.  
 Fig. 20. " diagram of rostrum and mentum.  
 Fig. 21. " spinnerets.

PLATE VII.

- Fig. 1. *Rhizococcus pulchellus*, adult female, dorsal view.  
 Fig. 2. " female of second stage, dorsal view.  
 Fig. 3. " antenna of adult female.  
 Fig. 4. " spines.  
 Fig. 5. " marginal spine and tube.  
 Fig. 6. *R. maculatus*, adult female, dorsal view.  
 Fig. 7. " female of second stage, dorsal view.  
 Fig. 8. " larva, dorsal view.  
 Fig. 9. " antenna of adult female.  
 Fig. 10. " claw and digitules of female.  
 Fig. 11. " anogenital ring.  
 Fig. 12. " antenna of larva.  
 Fig. 13. *Gossyparia cavellii*, insects on twig.  
 Fig. 14. " adult female, side view, on cotton.  
 Fig. 15. " " dorsal view, on cotton.  
 Fig. 16. " " dorsal view.



- Fig. 17. *Gossyparia cavellii*, larva, dorsal view.  
 Fig. 18. " antenna of adult female.  
 Fig. 19. " anal tubercles.  
 Fig. 20. " spinnerets.  
 Fig. 21. " male sac.  
 Fig. 22. " antenna of male.

## PLATE VIII.

- Fig. 1. *Dactylopius arecæ*, adult female, dorsal view.  
 Fig. 2. " antenna and eye.  
 Fig. 3. " rostrum and mentum.  
 Fig. 4. " foot.  
 Fig. 5. " extremity of abdomen.  
 Fig. 6. " spines and spinnerets.  
 Fig. 7. *D. aurilanus*, adult female, dorsal view.  
 Fig. 8. " antenna of female.  
 Fig. 9. " foot of female.  
 Fig. 10. " extremity of abdomen.  
 Fig. 11. " anogenital ring.  
 Fig. 12. " spinnerets.  
 Fig. 13. " female of second stage, dorsal view.  
 Fig. 14. " larva, dorsal view.  
 Fig. 15. " antenna of larva.  
 Fig. 16. " male, dorsal view.  
 Fig. 17. " head of male, dorsal view.  
 Fig. 18. " antenna of male.

## PLATE IX.

- Fig. 1. *Eriococcus raithbyi*, insects on leaves.  
 Fig. 2. " sac of female, upper view.  
 Fig. 3. " sac of male, upper view.  
 Fig. 4. " adult female, before gestation, dorsal view.  
 Fig. 5. " adult female, after gestation.  
 Fig. 6. " female of second stage, dorsal view.  
 Fig. 7. " larva, dorsal view.  
 Fig. 8. " antenna of adult female.  
 Fig. 9. " antenna of female of second stage.  
 Fig. 10. " antenna of larva.  
 Fig. 11. " foot of adult female.  
 Fig. 12. " claw and digitules.  
 Fig. 13. " anal tubercles and anogenital ring.  
 Fig. 14. " abdomen of male.  
 Fig. 15. " spike and appendage of male.  
 Fig. 16. " head of male, dorsal view.  
 Fig. 17. " antenna of male.  
 Fig. 18. " haltere of male.  
 Fig. 19. *Cælostoma assimile*, insects, second stage, in tests on twig.  
 Fig. 20. " female of second stage, dorsal view.  
 Fig. 21. " antenna of second stage.  
 Fig. 22. " mentum of second stage.  
 Fig. 23. " spiracle and trachea of second stage.  
 Fig. 24. " extremity of abdomen of second stage, with honey-dew (?) organ.

[NOTE.—With the exception of Plate IX., fig. 1, all the figures in these plates are much enlarged.]